



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10**

1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
WATER AND WATERSHEDS

MEMORANDUM

DATE: January 21, 2010

SUBJECT: Findings in Support of Use of Safe Drinking Water Act, Section 1431 to Address Contamination in Yakima Valley Groundwater, Washington

FROM: Eric Winiecki, Drinking Water Unit

TO: Michael A. Bussell, Director
Office of Water and Watersheds

THRU: Marie Jennings, Manager
Drinking Water Unit

I. PURPOSE

The purpose of this memorandum is to document EPA's finding that the basis for jurisdiction under Section 1431 of the Safe Drinking Water Act ("SDWA") is present in relation to Yakima Valley groundwater contamination. Specifically, Section 1431(a) of the SDWA, 42 U.S.C. § 300i(a), specifies that upon receiving information that a contaminant which is present in or is likely to enter an underground source of drinking water may present an imminent and substantial endangerment to the health of persons, and that appropriate State and local authorities have not acted to protect the health of such persons, EPA may take such action as deemed necessary in order to protect the health of such persons. Section 1431 further specifies that, to the extent that EPA determines it to be practicable in light of such imminent endangerment, EPA shall consult with the State and local authorities in order to confirm the correctness of the information on which the action proposed to be taken is based and to ascertain the action which such authorities are or will be taking.

II. BACKGROUND

A. Description of the Affected Area

The Yakima River Basin is located in central Washington State, and covers a substantial part of Yakima County. Of the approximately 75,000 people who live in the area, about one third rely on private wells that are not federally-regulated for their drinking water. Because deep wells are expensive, private residential wells are typically drilled into the shallow portions of the aquifer

and tend to be vulnerable to contamination. Unlike public water supplies, private wells are not subject to monitoring requirements. If they are sampled and found to be contaminated, there is no requirement to treat the water to health-based standards.

Agriculture is the primary economic activity in the area. Approximately 70-80% of the area is used for agriculture – most of which is irrigated. The major irrigation districts in the area include Grandview, Roza, Sunnyside Valley, Wapato Irrigation Project, and Zillah. Major commodities grown in the Basin include apples, pears, cherries, peaches, vegetables, hay, mint and hops. Dairy operations in the area were greatly expanded starting in the late 1980s. As of 2008, 61 dairies were registered with the Washington State Department of Agriculture in Yakima County. These facilities operated with approximately 139,000 milking animal units. Animal feeding operations that range from the very small home lots to large commercial feedlots are also present in the Valley. These operations are concentrated in the lower parts of the Valley in and around the cities of Sunnyside, Grandview, and Granger. The practice of surface application of commercial inorganic nitrogen fertilizers in irrigated portions of the Yakima Valley is also common. In addition, residential septic systems are prevalent.

1. Affected Community

In 2008, the population of Yakima County was 41% Hispanic and 5% Native American. Of Yakima residents, poverty impacts greater than 20% of the population and a little over one third of adults have less than a high school diploma. In 2004, 28% of migrant/seasonal farm workers and families in Washington State lived in Yakima County. Many of these migrant families settled in the Yakima Valley and have lived in the region for multiple generations. English is not the primary language (written or spoken) in many households in the Yakima Valley. So some private wells are used by members of the Yakama Nation, or by Spanish-speaking families participating in the local agricultural economy. Many rural residents are low income.

2. Western Area - The Toppenish Basin

This area consists of lands within the Yakama Nation. These lands are areas are under the jurisdiction of the Tribe. Land use is mixed and with open range and agriculture predominating.

The western or upper area lies entirely within the Toppenish Basin. The basin is bordered on the north by the Ahtanum Ridge, on the south by the Toppenish Ridge, and bisected by the Wapato Syncline. There are two main aquifers underlying the area. These include a surficial unconfined to semi-confined alluvial aquifer and basalt aquifers underlying the sedimentary deposits. The basalt is believed to be semi-isolated from the surficial aquifer and stream systems.

Groundwater flow within both aquifers generally follows topography with natural recharge occurring within the headlands and on the sides of the Valley and discharge occurring to the Yakima River. This produces a major flow direction from northwest to southeast, and a minor component flowing northeast to southwest and southwest to northeast. It is likely that the minor components of flow are significantly enhanced by irrigation practices upland from the Yakima River.

3. Eastern Area – The Benton Basin

This includes the non-reservation lands along the River and to the southeast side of the Valley. Approximately 60% of the Valley population resides in this area. The area includes the communities of Sunnyside, Granger, Grandview, and Mabton.

The Benton Basin lies in the southeastern part of the Yakima Valley. The western boundary of the basin abuts the eastern boundary of the Toppenish Basin. The southern boundary is bordered by the Horse Heaven Hills and the northeastern boundary generally follows the northern flank of the Cold Creek Syncline. Like the Toppenish Basin there appears to be two discrete aquifers systems, and unconfined and/or semi-confined alluvial aquifer, and a deeper basalt aquifer. Groundwater flows follows topography with natural recharge occurring within the headlands and discharge occurring towards the Yakima River. In this area, predominant groundwater flow is from the northwest toward the southeast.

III. CONTAMINANT PRESENT OR LIKELY TO ENTER THE UNDERGROUND SOURCE OF DRINKING WATER

A. Overview of Historical Water Quality Data

1. Sources of Data

There are four key data sources:

1. The 2001-2002 study conducted by the Valley Institute for Research and Education (VIRE),
2. USGS ground water sampling conducted in 1991-92 and 2003-04,
3. Washington State Department of Ecology sampling conducted as part of the Agricultural Chemical Pilot Study conducted in 1988, and
4. Washington State Department of Health public water supply data collected routinely from 1990 – 2008.

There have been numerous water quality investigations within the Yakima Valley over the years. The four primary investigations listed above are key because they cover the area, are essentially contemporaneous, use similar methods and the result can be spatially located and evaluated. Each set of data reflects unique study goals and constraints which can limit the ability to “homogenize” the data into a single cohesive set. These four studies reflect a large data set and have enough similarities they provide an overview of groundwater conditions. These studies document impact to surface and groundwater quality due the presence of both nitrate and bacteria and in the case of surface water, both legacy and currently used pesticides.

Based on available data, approximately 12% of wells sampled in the Yakima Basin exceeded the MCL for nitrate of 10 mg/L at least once during the period 1990 - 2008. Several of these wells exceeded the standard on numerous occasions. Ninety-eight out of 453, or 21 %, of these wells

had at least one nitrate sample between 5 and 9.9 mg/L during the 1990 -2008 period. Not all wells have been sampled in the Yakima Valley. Areas with elevated nitrate concentrations include locations in both the upper and lower area; however, wells in the lower area (Sunnyside, Mabton, Grandview) generally exhibited higher nitrate concentrations than those in the study area (Toppenish, Wapato, Zillah).

Nitrate-nitrogen concentrations are greatest in shallow groundwater. A significant decrease in nitrate-nitrogen concentrations is found in groundwater samples collected from depths below 300 feet. The highest percentage of samples exceeding State Drinking Water Standards (10 mg/l nitrate-nitrogen) are obtained from shallow wells (less than 300 feet deep). Most private domestic drinking water wells appear to be shallow wells.

The population in the Yakima Valley is served by a mix of public and private water supplies. The public systems primarily serve the large communities and the private wells are used in the more rural areas. It is estimated that approximately one third of Valley residents rely on private wells for drinking water (~24,000 residents). Many private wells in the area draw from the shallow portion of the surficial aquifer for drinking water, while public systems tend to rely on deeper wells or a mix of sources. The reviewed historical water quality data suggests that a significant number of residents that rely on these individual wells in the Yakima Valley may be exposed to drinking water which exceeds the nitrate-nitrogen drinking water MCL. There is some data to suggest that in addition to nitrate contamination the most vulnerable wells are also at risk to bacterial contamination (*Total coliform*, *fecal coliform* and *E. coli bacteria*). The Valley Institute for Research and Education collected data from the wells of low income households in 2001 and 2002. In some areas, up to 40% of the wells sampled were above 5 mg/L nitrate, a level that is recognized as a concern.

Agricultural practices, the use of fertilizer and the management of manure are linked to nitrate loading and incidents of nitrate contamination in groundwater. They can be significant inputs of nitrogen into the environment, but they may not be the only source. Other sources include on-site waste disposal systems along with residential and urban use of fertilizers can contribute to local nitrate hot spots. Failing waste water disposal systems can also be a localized source of bacterial contamination

2. Nitrate-Nitrogen Occurrence in Ground Water Related to Well Depth

A correlation between nitrate concentration and well depth has been observed in the Yakima Valley and other areas of the State where nitrate in groundwater is a concern. The correlation is particularly true in agricultural areas where shallow ground water is recharged with irrigation return flows from agricultural lands. The general correlation between depth and nitrate holds true for the Yakima Valley. Though there appears to be an impact on some deeper wells in the Yakima Valley.

Several reasons may account for this including well construction, basin geology, age of wells, presence of unused wells, lack of backflow prevention devices installed on wells, or lack of a

fully confining geologic layer in portions of the area. Nitrate is a contaminant that moves with groundwater. This coupled with the deep zone of unconfined and semi-confined sediments in the Yakima Valley may be enough of a factor to account for the deep impact of nitrate. Most of the large public water supply wells are drilled deep to maximize the volume of water needed to meet year round demand. However, because of construction costs, most private wells are generally not drilled beyond the point where groundwater is first encountered. It is expensive to go deeper. This practice tends to make the private wells more vulnerable to surface sources of contamination including nitrates.

The natural level of nitrate in ground water is expected to be low. In most areas of the State natural levels of nitrate in groundwater would be less than 2 mg/L. Concentrations of 2 mg/ L or above are higher than natural, and are indicative of some correlation to surface activities that involve organic waste products or fertilizer. With the introduction of agriculture over the last 100 years nitrates levels have risen in some areas of the basin. This is consistent with the number of shallow wells in the Valley that show elevated nitrates.

3. Bacteria

Bacteriological sampling of groundwater has occurred throughout the study since the 1990's. The overall number of sample results are significantly less than collected for nitrate. There are three main sources of bacteria data: 1) data collected from public water supply wells as part of the Washington State Department of Health's public water supply monitoring program; 2) data collected by the US Geological Survey during the course of several water quality investigations; and, 3) data collected as part of the Valley Institute for Research and Education 2002 study.

A review of the data indicates an overall tendency for shallow wells to exhibit a greater potential for bacteria impact than deeper wells. Bacteria was detected in one well deeper than 300 feet (of the 112 reviewed for which well depth data was available). However, bacteria was detected in 22 wells or 19% of the wells that are 300 feet or less in depth. There have been detections of total coliform, fecal coliform, and *E. coli* bacteria.

IV. THREAT TO THE HEALTH OF PERSONS

A. Regulatory Standard for Contaminants in Yakima Valley Drinking Water

The SDWA requires EPA to publish maximum contaminant level goals ("MCLGs") for contaminants which, in the judgment of the Administrator, may have an adverse effect on the health of persons and which are known or anticipated to occur in public water systems. MCLGs are to be set at a level at which no known or anticipated adverse effects on the health of persons would occur and which allow a margin of safety. See 40 C.F.R. § 141. At the same time that EPA publishes an MCLG, it must also promulgate a National Primary Drinking Water Regulation which includes either (1) a maximum contaminant level ("MCL") or (2) a required treatment technique. An MCL must be set as close to the MCLG as feasible taking into account economic feasibility of drinking water systems.

The MCLG and MCL for nitrate under the National Primary Drinking Water Regulations are 10 mg/l as nitrogen. See 40 C.F.R. § 141.62. EPA has established this drinking water standard to protect against the adverse effects of nitrate. See 40 C.F.R. § 141.32(e)(20). EPA believes that approximately 2000 people in the Yakima Valley are drinking water contaminated with nitrate above the MCL.

The MCLG for total coliforms, including fecal and *E.coli*, is zero, and the MCL is also zero, except where more than 40 routine samples are collected in a month in which case less than 5.0% of the samples must be total coliform positive under the National Primary Drinking Water Regulations (fecal coliform and *E.coli* bacteria must be zero). See 40 C.F.R. § 141.63. EPA has established this drinking water standard to protect against the adverse effects of coliforms. See 40 C.F.R. § 141.32(e)(11) & (12).

B. Health Effects of Contaminants in Yakima Valley Drinking Water

EPA has determined that nitrate poses an acute health concern at certain levels of exposure for certain receptors and that these levels are found in the Yakima Valley. Nitrate in drinking water is colorless and odorless. Ingested nitrate converts to nitrite in the body which interferes with the oxygen carrying capacity of blood. High levels of nitrate in water can also cause a blood disorder in infants known as methemoglobinemia ("blue baby syndrome") that can be fatal if left untreated. Infants up to three months of age are the most susceptible to adverse effects of nitrate ingestion. This is due to the fact that about 10 percent of ingested nitrate is transformed to nitrite in the adult and child, and 100 percent of ingested nitrate can be transformed to nitrite in the infant. Thus, infants with a weight of less than 4 kilograms (8.8 pounds) represent a high risk subpopulation. At 10 mg/l or higher concentrations, nitrate-nitrogen may pose a health threat to the population in general, and poses an acute health threat to children under six months of age.

Pregnant or lactating women, adults with reduced stomach acidity, and individuals deficient in the enzyme that changes methemoglobin back to normal hemoglobin are all susceptible to nitrite-induced methemoglobinemia. Some individuals with certain diseases, or through antioxidant medications or chemicals, have an increased susceptibility of methemoglobinemia.

Although most strains of *E. coli* bacteria are harmless and live in the intestines of healthy humans and animals, there are strains that are harmful to humans; they can cause severe illness. Infection with these strains of *E.coli* often causes severe bloody diarrhea and abdominal cramps; sometimes the infection causes non-bloody diarrhea.

In some people, particularly children under 5 years of age and the elderly, infection caused by certain *E. coli* bacteria can also cause a complication called hemolytic uremic syndrome, in which the red blood cells are destroyed and the kidneys fail. About 2%-7% of infections lead to this complication. In the United States, hemolytic uremic syndrome is the principal cause of acute kidney failure in children, and most cases of hemolytic uremic syndrome are caused by a strain of *E. coli*. Hemolytic uremic syndrome is a life-threatening condition usually treated in an

intensive care unit. Blood transfusions and kidney dialysis are often required. With intensive care, the death rate for hemolytic uremic syndrome is 3%-5%.

V. ACTION BY STATE, TRIBAL, AND LOCAL AUTHORITIES AND EPA CONSULTATION WITH THOSE AUTHORITIES

State, tribal, and local authorities have a variety of tools related to protection of ground water. However, these tools are limited, jurisdiction over the affected area is fragmented, and resources of the various agencies are scarce. EPA is coordinating with these other authorities to determine appropriate actions for the future. At this time, however, no State, tribal, or local authority is acting to investigate the sources of contamination to groundwater in the affected area, and only EPA appears capable of undertaking an immediate and comprehensive investigation of these sources. There is general agreement about the need for this step as a strategy is developed to address the contamination. In order for the elevated nitrate concentration in groundwater to be effectively addressed, EPA must conduct an investigation involving sampling wells in the area to determine the source of contamination. EPA intends to continue to coordinate with the variety of stakeholder groups, and State, tribal, and local agencies. EPA expects to continue to work with these other parties to support continued efforts to provide education and outreach, for example. We expect other steps to be taken concurrent with EPA's actions, including development of a long-term comprehensive strategy that focuses on assuring long term access to safe and reliable drinking water supplies for Valley residents.

VI. PROPOSED ACTION

Potential sources of nitrate, bacteria, and other contaminants include:

- runoff and infiltration of manure at feedlots, dairies, and other animal feeding operations;
- application of manure and chemical fertilizers to agricultural crops;
- spray-field application of nutrient-rich waste waters from the food processing industry; and,
- rural residential septic systems.

EPA plans to conduct two sampling events. First, EPA plans to collect nitrate samples from residential wells that are downgradient of the 34 potential nitrate sources that have been identified. EPA anticipates collecting about 150 total samples (34 sources X 4-5 samples downgradient of each = 150 samples).

EPA will seek access from residents to take a drinking water sample from their wells. EPA plans to sample wells for nitrate and total coliform, and also some basic chemistry parameters.

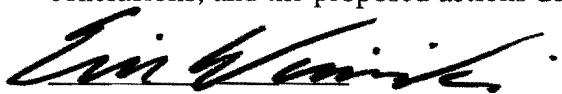
Preliminary results of the sampling will be reported and using that data EPA will narrow down the locations to conduct source characterization. Region 10 has invested about \$90,000 in a RARE research grant to investigate specific contaminant sources, which may identify the sources

of the nitrate, bacteria, and other contaminants which are endangering human health by contaminating groundwater in the affected area.

Source characterization sampling will be conducted to evaluate whether there is a link between contamination observed in down-gradient drinking water wells and potential contaminant sources. The source characterization work is expected to entail sampling groundwater, soils, lagoons, and perhaps other areas. A wider array of contaminants will be analyzed as a part of this effort.

VII. ENDANGERMENT DETERMINATION -- RECOMMENDATION

Based on the findings set forth in this memorandum, in accordance with Section 1431(a) of the SDWA, 42 U.S.C. § 300i(a), groundwater in the Yakima Valley Basin is an underground source of drinking water which is contaminated, and that this contamination may present an imminent and substantial endangerment to the health of persons. Although appropriate State, tribal and local authorities have taken some actions in response to the contamination in drinking water in the Yakima Valley, such actions are insufficient to protect the health of such persons. As documented in EPA's administrative record as set forth herein, EPA has consulted with the State, tribal, and local authorities regarding the information set forth in this memorandum and discussed the actions that such authorities are or will be taking. This memorandum is based on the administrative record for this matter. I recommend your approval of these findings and conclusions, and the proposed actions described above.

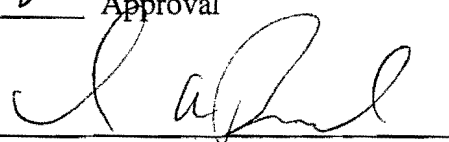


Eric Winiecki
Enforcement Protection Specialist

VIII. APPROVAL/DISAPPROVAL

Based on the information contained in this Memorandum or otherwise presented to me and included in the administrative record, I concur with the findings and conclusions above.

☒ Approval



Michael A. Bussell, Director
Office of Water and Watersheds

☐ Disapproval

1-25-2010
Date

**YAKIMA VALLEY GROUNDWATER CONTAMINATION
INDEX OF THE ADMINISTRATIVE RECORD SUPPORTING
SAFE DRINKING WATER ACT SECTION 1431
FINDING OF IMMINENT AND SUBSTANTIAL ENDANGERMENT**

**1973-74 USGS Study: "Quality of Surface Water and Ground Waters, Yakama Indian Reservation", USGS Report 77-128
by M.O. Fretwell and Prepared in cooperation with the Yakama Tribal Council**

This study was done to provide general water-quality information and to aid the council in water-resources management. Objectives include the following:

- ♦ Evaluate surface & groundwater throughout the reservation
 - ♦ determine the nature of existing or potential water-quality problems
 - ♦ Define the water quality in terms of suitability for various uses.
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**1989 Study: "Selected Water – Quality Data for the Toppenish Creek Basin, Yakima Indian Reservation, Washington 1989"
by Payne and S. S. Sumioka, USGS**

Presents data on Nitrogen and indicator bacteria in groundwater.

1990 Ecology Study: "Washington State Agricultural Chemicals Pilot Study, Final Report" by Denis Erickson and Dale Norton, Washington State Department of Ecology and the Washington Department of Agriculture

This study provides reconnaissance information on the presence and concentration of pesticides in Washington's groundwater.

October 2001 Washington Department of Ecology Study: Granger Drain Fecal Coliform Bacteria Total Maximum Daily Load Assessment and Evaluation

Examined the sources of fecal coliform contamination to surface water in the Granger Drain.

2002 Study: "Quality of Ground Water in Private Wells in the Lower Yakima Valley, 2001-02" by Ron Sell & L. Knutson, December 2002, Valley Institute for Research and Education

- ♦ Valley Institute for Research and Education (VIRE) conducted free water testing for low-income residents of the valley to apprise participants of the quality of their drinking water.
 - ♦ Gather baseline data on the quality of the groundwater in the area.
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2003 Ecology Study: "Groundwater Quality in the Central Ahtanum Valley, Yakima County, March 2001 – December 2002"
by Washington State Department of Ecology

Report summarizes a 2-year sampling effort to evaluate groundwater quality conditions in the central Ahtanum Valley, of Yakima County.

2003 Heritage College Study: "Sunnyside Groundwater Study, Final Report", August 13, 2003

This was a student training exercise to investigate groundwater quality.

2006 USGS Study: "Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins, Yakima River Basin, Washington" Report 2006-5116 by M. A. Jones, J.J. Vaccaro, and A.M. Watkins, USGS (Written in cooperation the Bureau of Reclamation, Washington Department of Ecology and the Yakama Nation)

This purpose of this study was to describe the groundwater flow system and its interaction with and relation to surface water; and to provide information to support development of a tool, a numerical model.

2008 USGS Study: "Extent and Depth to Top of Basalt and Interbed hydrogeologic Units, Yakima River Basin Aquifer System, Washington" Report 2008-5045 by M.A. Jones and J.J. Vaccaro, USGS

This study was launched in June of 2000 to obtain an understanding of the ground-water flow system and its relation to the surface-water resources needed to implement water resources management strategies in the basin.

The study was also done to provide baseline information for a management tool—numerical model. The conceptual model of the flow system and the results of the study were supposed to be used to support actions taken by management agencies with respect to GW availability and to provide information to other stakeholders and interested parties.

January 2008 Sampling of Outlook Elementary School

Purpose was to sample drinking water wells to assess high nitrate concentrations at the school, provide hands on experience to Connex College students, sample private wells, inform participants about the sample results

August 2008 USGS Study: "Distribution of Elevated Nitrate Concentrations in Ground Water in Washington State", by USGS

This study was designed to estimate the probability of detecting elevated nitrate in GW in Washington State.

August 2008 El Proyecto Bienestar: EPA Care Grant Results (Connex College Summer Program Students)

This project was designed to provide hands on experience to college students, sample private wells, and inform participating households about the quality of their drinking water.

2009 USGS Study: "Effect of Agricultural Practices on Hydrology and Water Chemistry in a Small Irrigated Catchment, Yakima River Basin, Washington"

Explores the role of irrigation and artificial drainage in the hydrologic cycle and the transport of solutes in a small agricultural catchment in the Yakima valley.

Letter dated January 19, 2010, from J. Rand Elliott, Commissioner, Board of Yakima County Commissioners, to Ted Sturdevant, Director, Washington Department of Ecology.

Letter requests designation of a Ground Water Management Area in the lower Yakima Valley to address impaired groundwater quality.

EPA Consumer Fact Sheet on Nitrates/Nitrites

Basic Information about Nitrate in Drinking Water, by USEPA

Basic Information about *E. Coli* 0157:H7 in Drinking Water, by USEPA